

## CLAIMS

1. A polymer electrolyte fuel cell comprising: a hydrogen ion conductive polymer electrolyte membrane; and a pair of electrodes having catalyst layers sandwiching said hydrogen ion conductive polymer electrolyte membrane therebetween and gas diffusion layers in contact with said catalyst layers, wherein at least the catalyst layer of one of said electrodes comprises carbon particles supporting a noble metal catalyst, and said carbon particles include at least two kinds of carbon particles adsorbing a hydrogen ion conductive polymer electrolyte in mutually different dispersed states.

2. The polymer electrolyte fuel cell as set forth in claim 1,

wherein the at least two kinds of carbon particles differ from each other in specific surface area or DBP oil adsorption.

3. The polymer electrolyte fuel cell as set forth in claim 1,

wherein a particle size of said hydrogen ion conductive polymer electrolyte is within a range of 30 to 200 nm when measured by a light-scattering photometer.

4. The polymer electrolyte fuel cell as set forth in

claim 1,

wherein the at least two kinds of carbon particles include first carbon particles having a specific surface area of 30 to 400 m<sup>2</sup>/g and second carbon particles having a specific surface area of 400 to 1600 m<sup>2</sup>/g, and

particle sizes of hydrogen ion conductive polymer electrolyte adsorbed to said first and second carbon particles are within a range of 30 to 200 nm and a range of 200 to 500 nm, respectively, when measured by a light-scattering photometer.

5. The polymer electrolyte fuel cell as set forth in claim 1,

wherein 85° glossiness of a surface of the catalyst layer of at least one of said electrodes measured by an evaluation method of JIS-Z8741 is not less than 20%.

6. A method for manufacturing a polymer electrolyte fuel cell, comprising the steps of

(i) adsorbing a polymer electrolyte to first carbon particles supporting a catalyst in a first dispersion in which said polymer electrolyte is dispersed;

(ii) adsorbing a polymer electrolyte to second carbon particles supporting a catalyst in a second dispersion in which said polymer electrolyte is dispersed;

(iii) preparing a catalyst layer ink by mixing said

first and second dispersions; and

(iv) forming a catalyst layer from said catalyst layer ink; and further comprising the step of

(v) adjusting a particle size of said polymer electrolyte by mixing a first solvent in which said polymer electrolyte is dispersed with a second solvent having a dielectric constant different from that of said first solvent before adsorbing said polymer electrolyte to said carbon particles in at least one of said first and second dispersions.

7. The method for manufacturing a polymer electrolyte fuel cell as set forth in claim 6,

wherein a solvent of said first dispersion is a mixture of an alcohol and a second solvent having no hydroxyl group, and

the step of adjusting the particle size of said polymer electrolyte is implemented by mixing an alcohol dispersion of said polymer electrolyte with said second solvent in which said first carbon particles are dispersed.

8. The method for manufacturing a polymer electrolyte fuel cell as set forth in claim 6,

wherein said step (iv) is the step of forming a catalyst layer by applying said catalyst layer ink on one surface of a gas diffusion layer and whereby producing an electrode, and

said method further comprises the step of integrally joining the produced electrode to at least one surface of a polymer electrolyte membrane by application of pressure.

9. The method for manufacturing a polymer electrolyte fuel cell as set forth in claim 6,

wherein said step (iv) is the step of forming a catalyst layer by applying said catalyst layer ink on at least one surface of a polymer electrolyte membrane and whereby forming a membrane-catalyst layer assembly, and

said method further comprises the step of integrally joining a gas diffusion layer to a catalyst layer side of said membrane-catalyst layer assembly by application of pressure.

10. The method for manufacturing a polymer electrolyte fuel cell as set forth in claim 6,

wherein said step (iv) includes the step of forming a catalyst layer by applying said catalyst layer ink on a transfer film and the step of forming a membrane-catalyst layer assembly by transferring said catalyst layer to at least one surface of a polymer electrolyte membrane, and

said method further comprises the step of integrally joining a gas diffusion layer to a catalyst layer side of said membrane-catalyst layer assembly by application of pressure.

11. The method for manufacturing a polymer

electrolyte fuel cell as set forth in claim 6, comprising the step of dispersing the catalyst-supporting carbon particles in said catalyst layer ink so as to have a particle size distribution within a median diameter range of 0.1 to 3  $\mu\text{m}$ .

12. The method for manufacturing a polymer electrolyte fuel cell as set forth in claim 6, comprising the step of applying hydrophilicity treatment to the carbon particles supporting the catalyst before adsorbing said polymer electrolyte.

13. The method for manufacturing a polymer electrolyte fuel cell as set forth in claim 9,

wherein a surface tension of a dispersion medium of said catalyst layer ink is smaller than a critical surface tension of said polymer electrolyte membrane.

14. The method for manufacturing a polymer electrolyte fuel cell as set forth in claim 10,

wherein a surface tension of a dispersion medium of said catalyst layer ink is smaller than a critical surface tension of said transfer film.